deavor to imitate the author's infinite capacity for taking pains to overcome every difficulty and eliminate every source of error. By such work modern science is placed on a sure foundation, and besides new avenues of research are opened up. It is a mistake to suppose that investigations of high precision do not lead to new discoveries. Lord Rayleigh's exact measurements of the densities of the common gases resulted in the discovery of argon, and many similar examples could be given. It would be truer to say that inexact work often leads to discoveries being missed which ought to have been made and besides rough work generally leads to erroneous conclusions which others have to waste valuable time and energy setting right. Millikan, for example, has had to spend considerable time setting right the erroneous conclusions of Ehrenhaft on the existence of a "sub-electron," conclusions which ought never to have been drawn.

Millikan's new book is admirably printed and illustrated and seems very free from typographical errors. It is dedicated to Michelson and Ryerson and forms a record of work worthy of the inspiration of the former and the generosity of the latter. H. A. W.

MINERALS OF JAPAN

VALUABLE service has been rendered to mineralogy by Dr. Wada in his editorship of the "Beiträge zur Mineralogie von Japan," the articles in which, in spite of the German title, have been almost all in English. The latest issue[1] contains two articles on the minerals of Korea by Nobuyo Fukuchi, describing specimens of sixty different minerals (pp. 207–228). Other papers treat of prismatic sulphur from Formosa, by Masakichi Suzuki; the optical properties of danburite from Bungo Province, Japan, by Mikio Kawamura; epidote crystals from Iwaki Province, by Kinzô Nakashîma; ferberite from Kai Province and hübnerite from Shimotsuke Providence, by Kotora Jümbô. A paper of special interest is that on the aragonite cones formed at the Kurujama Geysers, in Yuzawa, Shimotsuke Province, Japan. A cone 30 cm. in height was formed by the hot water of one of the geysers in a period of ten months.

In his work on "The Minerals of Japan," Dr. Tsunashirô Wada[2] gives in concise and systematic form characterizations of the various mineral forms that had been observed in Japan up to the date of his treatise. His thorough training in European methods added to his familiarity with the geology of his native land make this book a trustworthy source of information. The crystallographic details are quite fully given and constitute one of the most valuable features of the work for the mineralogical student.

As to the metals of Japan, Dr. Wada notes that the richest gold deposits are those on the island of Formosa (p. 12), the chief localities being Zucho Kinkwaseki near Taihoku, in the northeastern part of the island. Quartz veins traversing a volcanic rock are sometimes found bearing a large quantity of native gold. Frequently the yellow surface has a coating of limonite formed by the decomposition of pyrites. There are also alluvial gold deposits in Formosa. In Japan proper the rich placers in the Hokkaido are extensively worked; one crystal from the mining district of Esashi measured 6–10 mm. along the edges of its octahedron. The largest nugget was found in 1900 at the Usotannai in Esashi; it weighed 769.2 grams (2 pounds 15 2/3 dwts. Troy), the dimensions being $106 \times 63 \times 25$ mm. (p. 13) and the intrinsic value about $500. The oldest known gold mine in Japan is that of Sado.

As in many parts of the world, platinum is found in association with gold in Japan, for example in the Yubari-gawa and Pechan rivers in the Hokkaido, and it occurs with gold and iron sands in Nishi-Mikawa. Copper and silver are also met with in a number of localities, but crystallized silver has never been found in Japan.

Of the ornamental or gem stones the ame-

[1] "Beiträge zur Mineralogie von Japan," ed. by T. Wada, No. 5, November, Tôkyô, 1915 (pp. 207–305 of the series, one plate).

[2] Tsunashirô Wada, "Minerals of Japan," transl. by Takudzi Ogawa, Tôkyô, 1904, vii + 144 pp., 30 pls., 8vo.

thyst of Fujiya, Hoki Province, must be noted, and rose quartz is found at Gota. Maki Province (pp. 46, 47). Inclusions of quartz come chiefly from Mukaiyama and Takemori, the green fibrous inclusions being epidote and the brown fibrous ones tourmaline; included sulphur of a beautiful yellow is limited to quartz of Takemori. Fluid inclusions are quite common, being usually distributed irregularly throughout the crystal, though sometimes in definite layers parallel to the faces of the rhombohedron (p. 44). Felspar, tourmaline and garnet are here found in association with quartz. Localities well known since ancient times for beautiful quartz crystals are the granitic regions around Kimpû-zan, Kai Province. Here colorless and transparent crystals for ornamental work have been obtained for centuries (p. 38). It is well known that the manufacture of beautiful crystal balls has long been carried on in Japan.

A small crystal of crysoberyl has been found in stanniferous sand of Takayama, Mino Province; it was of a pale greenish-yellow color (p. 82). Beautiful crystals of vivianite were at one time met with at Ashio, Shimotsuke Province. At first they were light blue, but became darker on exposure to the air (p. 86). Some blue, transparent crystals of tourmaline have been found at Takayama, Mino Province, and beryl found here resembles the tourmaline in color and form, one end of the crystal being of a lighter hue, while the other end is decidedly darker and only semi-transparent. The topaz, however, is the most conspicuous of the gems found in Japan and Dr. Wada gives a very full account both of the occurrences and of the crystallographic forms (pp. 89–113). It occurs in pegmatite veins in granite as in Takayama and Hosokute, Mino Province, Ishigure, Ise Province, and Tanokamiyama, Omi Province. Japanese topazes were first exhibited in the National Exposition of Tokio in 1877. Six different hues have been observed, as follows: (1) Colorless; (2) wine-yellow, or bluish-yellow; (3) pale blue; (4) pale brown and pale blue in sectors; (5) pale green; (6) brown. On exposure to daylight the brown and brownish-yellow shade into blue, and the blue tends to become colorless. The brown hue is confined to a few freshly-quarried specimens, and is never observable in those which have been kept long in daylight. In some specimens the structure is shown by inclusions arranged parallel to the outline of the crystals, producing the strange effect observable in the so-called "phantom quartz."

The most beautiful of the topaz crystals illustrated by Dr. Wada (Plate XXIV., Fig. *a*) was found between 1870 and 1880. It came later into the possession of Count K. Inowe who presented it to Dr. Wada. It measures 84 mm. in length, 64 mm. in the longer diameter and 51 mm. in the shorter. It is based on a piece of felspar, and on the side is black quartz crystal, the topaz standing nearly perpendicular to its prismatic faces.

Geo. F. Kunz

New York City

SPECIAL ARTICLES

THE GEOMETRICAL MEAN AS A B. COLI INDEX

Several reasonable objections have dissatisfied bacteriologists with the present methods of estimating the average number of *B. coli* in water.[1] The following method is proposed as a simple, convenient, and theoretically desirable means of arriving at a numerical index representing such a series of results. It was suggested in 1912 by data obtained at the Washington Filter Plant,[2] and has since been practically applied with much success.

Data—*B. coli* are determined to be present or absent in a series of fermentation tubes containing portions of the sample in multiples of ten, *i. e.*, 10 c.c., 1 c.c., .1 c.c., .01 c.c., .001c.c., etc.

Example: Suppose twenty samples or series of tubes gave the following results, where + or positive means *B. coli* were found present,

[1] Report of the Committee on Standard Methods, American Public Health Association, 1916.

[2] Wells, W. F., "Some Notes on the Use of Alum in Connection with Slow Sand Filtration at Washington, D. C.," Proceedings of American Water Works Association, 1913.